

REMARKS

Claims 1-10 and 14 are pending. Claims 6-9 have been withdrawn. All of the remaining claims 1-5, 10 and 14 are rejected on prior art grounds in an Office Action dated 28 July 2006. Applicant respectfully submits that the claims, in their current form, are patentably distinguished from the relied-upon references and thus the application is allowable. The Examiner various rejections are now addressed in turn.

Claims 1-5 and 10 are rejected as allegedly lacking novelty in view of U.S. Patent No. 5,555,306 to Gerzon. However, as will now be discussed in detail, Gerzon does not teach or even suggest all of the limitations of independent claims 1 and 10. Thus, these claims, and claims 2-5 depending therefrom, are novel over Gerzon.

The Gerzon patent does generally relate to room simulation. The method and device disclosed in Gerzon are, however, fundamentally different from that of the present invention, even though some of the words and phrasings appear quite similar and may cause some confusion at first.

The present invention involves early pattern generators (EPG) that establish a simulation of true sound reflections caused by a sound source. Exemplary implementations of an EPG in one embodiment of the invention are shown in figures 4a and 4b of the present application. The illustrated EPG comprises diffusers, equalizers, delay lines and gains, and the different reflections may thus be tapped at appropriate delay lines. The simulated reflections are not summed together if representing different directions, but instead are preserved as individual channels. The simulated reflections are therefore true to the time-dimension in that they may have different delays, and true to the direction-dimension in that they may be processed individually in subsequent stages.

To the contrary, the "early reflection simulator" of Gerzon establishes a single channel comprising a sum of simulations of early reflections. An implementation of the early reflection simulator is shown in Figure 4 of Gerzon. From the single input-signal 22 are tapped signals 12_1 , 12_i , 12_n at different delays and with different gains 13_1 , 13_i , 13_n ,

and these signals are then summed into a single output signal. Hence, the simulated reflections represented by the single output channel are true to the time-dimension of early reflections, but miss the directional information involved with a true representation of early reflections (as the source sound is reflected from the different walls and other surfaces in the room, the true reflections will necessarily reach the listening position from different directions).

Gerzon, at Col. 7, lines 45-58, describes that the reflection simulators may also process multi-directional signals (e.g. stereo). This is implemented by receiving a multi-directional signal as input, processing each channel in parallel simulators, and outputting a multi-directional signal. Hence, Gerzon does not establish directional information. The reference requires a directional input signal in order to output a directional output signal. In other words, Gerzon may process directional information, but is not able to provide it from scratch.

Furthermore, the present invention involves a plurality of input sources. According to claim 1 it establishes a signal with N directional components according to the above explanation for each input, and then adds the outputs from each generator to provide a single signal with N directional components. This is shown in Figures 2 and 3a of the present application. Thereby, reflections representing same directions but different sound sources are combined. The result is preservation of individual directional information, preservation of time information, but abandonment of sound source information. Among other things this means that the individual locations of the sound sources are reflected in the output signals, but only a single listening position is supported as the simulated reflections are grouped by their direction to the listening position.

Gerzon discloses the embodiment of its Figure 5 for support of several input sources. Here the individual source signals are summed together to a single signal by the adder 8 before the simulator 1 calculates the reflections. Because of the individual delays 4_1 , 4_j , 4_n , different distances to the sound sources may be preserved in the resulting signal, but different directions to the sound sources are lost. Again, the Gerzon method

preserves the time-dimension, but abandons the direction-dimension of early reflections. And, Gerzon of course also abandons sound source information because of the adder.

Furthermore, the present invention involves a plurality of early pattern generators, e.g. one for each sound source. See, e.g., Figures 2 and 3a. This provides for preservation of directional information for each sound source. Only after calculation of early reflections for each sound source, the signals are combined into a single with N directional components.

Gerzon uses only one early reflection simulator, as the reference combines the sound source signals before calculating the reflections. Thereby Gerzon simplifies the case with several input sources, as explicitly stated in the reference as an object (Col 9, lines 27-33) but loses the individual directional information for the sources.

The embodiment of Gerzon's Figure 8 does appear to indicate several early reflection simulators. This is however a different approach from the claimed invention. Particularly, in Gerzon's Figure 8, one sound source is processed by several simulators. Hence, it does not anticipate the present invention where several sources are processed by several early pattern generators.

In short, two fundamental differences between Gerzon and Applicant's claimed invention are: (1) Gerzon does not provide directional information, only time-information; and (2) Gerzon does not provide reflection simulation for each input source, but instead processes all sources in common, causing loss of directional information.

Hence, for at least these reasons, it is clear that Gerzon does not anticipate Applicant's claims. Specifically, Applicant submits that the claim requirements of "at least two inputs" and "at least two early pattern generators" are taught or even suggested by Gerzon. Furthermore, when interpreted correctly in the context of the claimed invention, Applicant's claim limitation, "output having N directional components", is also not taught or otherwise disclosed by Gerzon. This is because, Gerzon's multi-directional signals, e.g. stereo signals, do not comprise discrete directional channels, but instead are correlated, panned directional signals.

Accordingly, for at least these reasons, Gerzon does not provide each and every limitation of independent claims 1 and 10. Thus, these claims are novel over Gerzon; reconsideration and withdrawal of the outstanding §102 rejections is respectfully requested. Claims 1 and 10 are not further rejected or objected to and are thus allowable to Applicant.

As mentioned initially, claims 2-5 are also rejected as lacking novelty with respect to Gerzon. These claims, however, variously depend from allowable claim 1 and are thus correspondingly allowable to Applicant; reconsideration and withdrawal of the relevant §102 rejections is respectfully requested.

Claim 14 is rejected under 35 U.S.C. §102(e) as allegedly lacking novelty with respect to U.S. Patent No. 5,862,233 to Poletti. Similarly to claim 1, Applicant's claim 14 recites "at least two inputs", "at least two reverberation units", and "each of said at least two reverberation units establishing an output having N directional components". For at least the reasons specified above, these limitations are not found in Gerzon. Moreover, Applicant submits that the Poletti reference does not remedy the deficiencies of Gerzon.

Poletti teaches a wideband non-in-line assisted reverberation system (col. 4 line 14) which generally is a system for adapting the natural reverberation of a room for live performances. Assisted reverberation systems comprise the listening room itself and an electronic system for adapting the performance experienced in that room. Hence, the audience hears the natural direct sound from the performer(s), the early reflections and the sound tail signal, i.e., late reverberation established naturally by the room and artificial reverberation sound established by the assisted reverberation system and output through loudspeakers. Moreover, feedback from the loudspeakers through the room to the microphones exists in such systems. Actually, with the wording of Poletti, such a system may be seen as simulating placement of a secondary room in a feed back loop around the main auditorium with no two-way acoustic coupling (see col. 4 line 57-59). Hence, the forward path is the actual room, the feedback path is through the electronic

system, and the feedback signal is injected into the forward path by means of loudspeakers.

The signal processing unit of the present invention is used for on the basis of a “clean” signal, i.e. without reverberation, from each source, e.g. instrument of an orchestra, establishing a representation of the spatial sound picture that corresponds to playing that source in a desired, imaginary room. The spatial sound picture representation from each source may, according to the present invention, easily be added to form a composite spatial sound picture representation comprising all sources. This representation is referred to as a signal having N directional components, as generally recited in present claim 14. Hence, the present invention does not incorporate the actual room, neither its early reflections, nor as a means for feedback to the source. Everything is carried out inside electronic or digital processing means and the sound is, as far as the subject-matter of the claims are concerned, only represented as signals and never actually heard. Of course the invention aims for eventual rendering by loudspeakers, but not as part of the processing or system. Hence, the forward path is purely electronic or digital and no feedback path exists.

Hence, the system of Poletti and the invention of claim 14 are fundamentally different in their purpose, their means and their starting point. Poletti does not disclose any inputs in the sense of the present invention. With the electronic part of the system Poletti discloses use of several omni-directional microphones for picking up reverberant sound in the room. Hence, those microphones do not represent sources but are merely pick-up points for the feedback path of the system. Poletti does not care about the performers/sources, the sound of which is conveyed to the audience by means of the room. Moreover, Poletti does not disclose each input being connected to an early pattern generator establishing an output comprising N directional components. The system of Poletti relies on the actual room for the establishment of early reflections and only produces sound tail signals, i.e. late response, in addition to the late response of the room. Poletti mentions, however, in col. 6 line 24 that control of early reflections may be part of the system, but does not in any way describe what that would comprise, how it should be done, how it would interact with the input or what output it would establish. Moreover,

in the system of Poletti no directionality is preserved. The purpose is, on the contrary, to establish a non-directional complex mixture of sound, a "soup", comprising a lot of indistinguishable and omnidirectional echoes of the sound picked up in the room, in order to convincingly simulate the late response of a concert hall or other big room. Poletti does not disclose the use of any signals having a plurality of directional components and does not disclose any N directional component signals being added to form one N directional component signal.

Accordingly, for at least these reasons, Poletti does not provide each and every limitation of independent claim 14. Thus, this claim is novel over Poletti; reconsideration and withdrawal of the outstanding §102 rejection is respectfully requested. Claim 14 is not further rejected or objected to and is thus allowable to Applicant.

As set forth above, all of the outstanding novelty rejections have been addressed and are herein overcome. Accordingly, withdrawal of all rejections and prompt issuance of a Notice of Allowance are respectfully requested.

Applicant hereby petitions under 37 C.F.R. §1.136 for any extension of time necessary for entry and consideration of the present Response.

The Examiner is invited to contact Applicant's attorneys at the below-indicated telephone number regarding this Response or otherwise concerning the present application. Please charge any required fees for this Response, or otherwise concerning the present application, to Deposit Account No. 06-1130 maintained by Applicant's attorney.

Respectfully submitted,
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